A Psycholinguistic Study on Dative Verb Sentences with Scrambled Word Order in Japanese

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Yuichiro Fukumitsu

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要旨

文理解時におけるスクランブリングの影響を調べるために，日本語の与格動詞文を対象とする読み時間を測定する実験を行い，基本語順文の読み時間に比べ，かき混ぜ文の読み時間が有意に長いことが示された。このことは，かき混ぜ文の理解時により多くの認知的負荷を必要することを示唆し，また理論言語学における，かき混ぜ文が基本語順文より複雑な構造をもつ，とする主張を支持するものである。

1. Introduction

In the field of theoretical linguistics it is widely accepted that Scrambling, which has been considered to be one of the syntactic movements, provides free word order phenomenon in languages such as Japanese. Scrambling is supposed to derive a sentence with scrambled word order from a sentence with canonical word order by means of displacement of an NP from the base position to the sentence initial position, as shown in (1).

(1) a. Hanako-ga ringo-o tabeta.
Hanako-NOM apple-ACC eat-PAST
"Hanako ate an apple."
b. Ringo-o Hanako-ga tabeta.

The sentence in (1a) has canonical word order and the sentence in (1b) has scrambled word order. According to Saito (1985), though sentences (1a) and (1b) have the same meaning, the two sentences in (1) have different syntactic structures. (1b), in which the order of the subject and the object is reversed, has a more complex syntactic structure than the one in (1a). The following examples

illustrate that in a sentence with the scrambled word order, the accusative object NP has moved and adjoined to IP, leaving behind a trace at its base position.

(2) a. [$_{IP}$ NP-NOM NP-ACC Verb] *Canonical word order*
b. [$_{IP}$ NP-ACC [$_{IP}$ NP-NOM *t* Verb]] *Scrambled word order*

This structural difference has called a number of psycholinguistic researches to investigate if the two sentences with different word order can be processed in the identical manner. Since Chujo (1983), many researches have reported that in Japanese, processing of sentences with scrambled word order is different from that of sentences with canonical word order in that the displaced NPs are moved back to their base positions in a manner of gap-filling parsing (Frazier and Clifton 1989). The previous studies have found cognitive load related to scrambling effects in Japanese in reading time studies (e.g. Tamaoka et al. 2005), eye movement studies (e.g. Mazuka et al. 2002) and also in neuro-imaging studies (e.g. Kim et al. 2004).

However, these researches so far have targeted mostly mono-transitive accusative verb sentences or ditransitive constructions, and to my knowledge there has been no study regarding scrambling effects on mono-transitive dative verb sentences, in which objects receive dative case marking. In this study, thus, we carried out a psycholinguistic experiment to reveal the nature of the scrambling effects on mono-transitive dative verb sentences in Japanese.

2. Dative Object *NP-ni*

The examples in (3) and (4) below show that, in addition to mono-transitive accusative verb sentences, Japanese has mono-transitive dative verb sentences with case particle *ni* attached to the object NP, which is one of the arguments of the main verb. So the absence of the object NP makes the sentences incomplete.

(3) a. Taro-ga gakkoo-ni itta.
Taro-NOM school-DAT go-PAST
"Taro went to school."

b.#Taro-ga itta.
Taro-NOM go-PAST

(4) a. Jiro-ga Kaori-ni horeta.
Jiro-NOM Kaori-DAT fall-in-love-PAST
"Jiro fell in love with Kaori."
b.#Jiro-ga horeta.
Jiro-NOM fall-in-love-PAST

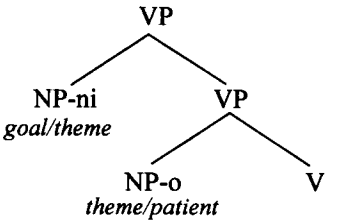
In the dative verb sentences (3a) and (4a), as is the case in accusative verb sentences, the order of the subject and the object can be reversed without changing meaning of the sentences, as shown in (5).

(5) a. Gakkoo-ni Taro-ga itta.
school-DAT Taro-NOM go-PAST
b. Kaori-ni Jiro-ga horeta.
Kaori-DAT Jiro-NOM fall-in-love-PAST

It is safe to say that free word order phenomenon in dative verb sentences is derived by means of scrambling, displacement of the object NP with dative case particle *ni*. However, it is not mature enough to conclude that, in terms of sentence processing, free word order phenomenon in dative verb sentences can be dealt with in the same line with that of accusative just because of their apparent similarity.

As to dative objects in Japanese, there are two kinds of complicate matters to take into account. First, it is well known that, crosslinguistically, accusative and dative objects have different syntactic and semantic properties. More specifically it is argued that they are given different thematic roles and hence appear in structurally different positions (Baker 1988). In Japanese, it is generally assumed that accusative objects with case particle *-o* are given theme or patient role and dative objects with case particle *-ni* are given goal or theme role depending on main verbs, and that the two types of objects with different case markers reside in different syntactic positions, illustrated in (6).

(6)



Considering the different syntactic properties between accusative and dative objects, there is enough reason to carry out another study targeting only dative verb sentences.

In addition to the crosslinguistic nature of dative objects, there is much about post-NP particle *ni* in Japanese. According to Miyagawa's (1989) classification of NP particles in Japanese, there are two types of post-NP particles, case markers and postpositions. Case markers are a realization of abstract Case, which criticizes to an argument NP in a thematic relation with a main verb. Postpositions, on the other hand, are heads of postpositional phrases, projecting their own maximal projections. Postpositional phrases are generally considered to be adjuncts, whose syntactic properties are largely different from those of argument NPs with case marker. Following Miyagawa (1989), Sadakane and Koizumi (1995) extensively discuss the nature of particle *ni* with abundant data and conclude that there are four types of *ni* in Japanese, as summarized in (7).

(7) Sadakane & Koizumi's (1995) Classification of Post-NP Particle *ni*

a. the dative case marker

Emi-wa Mika-ni bara-no hanataba-o ageta.
Emi-TOP Mika-NI rose-GEN bouquet-ACC give-PAST
"Emi gave Mika a bouquet of roses."

b. the postposition

Kanta-no ronbun-wa GB riron-ni motozuiteiru.
Kanta-GEN paper-TOP GB theory-NI based-on-PAST
"Kanta's paper is based on the GB theory."

c. the *ni* of *ni* insertion

Kanta-wa Emi-ni butai-no ue-de odoraseta.
Kanta-GEN Emi-NI stage-GEN top-on dance-CAUS-PAST
"Kanta had Emi dance on the stage."

d. a form of copula

Mika-wa heya-o kirei-ni katazuketa.
Mika-TOP room-ACC beautiful-NI clean-up-PAST
"Mika cleaned up her room beautifully."

In order to investigate scrambling effects on dative verb sentences, it is desirable to use only sentences involving argument dative objects with case particle *ni* such as (3a) and (4a) repeatedly shown below, since post-NP particle *ni* has various syntactic and semantic properties as mentioned in (7).

(3a) Taro-ga gakkoo-ni itta.
Taro-NOM school-DAT go-PAST
"Taro went to school."

(4a) Jiro-ga Kaori-ni horeta.
Jiro-NOM Kaori-DAT fall-in-love-PAST
"Jiro fell in love with Kaori."

In (3a) the main verb *itta* "went" requires two argument NPs, the nominative subject *Taro-ga* "Taro-NOM" with agent role and the dative object *gakkou-ni* "school-DAT" with goal role. The main verb *horeta* "fell-in-love" in (4a) also requires two arguments, the nominative subject *Jiro-ga* "Jiro-NOM" with experiencer role and the dative object *Kaori-ni* "Kaori-DAT" with theme role. Though the sentences in (3a) and (4a) are of slightly different semantic types, there is a similarity between them in that both have their Permissive Causatives counterparts like (8).

(8) a. Hahaoya-ga Taro-ni gakkoo-ni ik-ase-ta.
Mother-NOM Taro-DAT school-DAT go-CAUS-PAST
"Taro's mother let Taro go to school."

b. Goro-ga Jiro-ni Kaori-ni hore-sase-ta.
Goro-NOM Jiro-DAT Kaori-DAT fall-in-love-CAUS-PAST
"Goro let Jiro fell in love with Kaori."

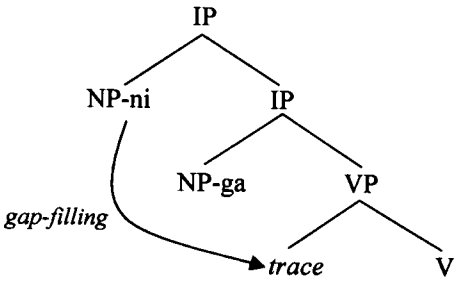
In Permissive Causatives, case particle *ga* of the underlying agentive subject *Taro* in (3), for example, has been replaced with case particle *ni* in (8a). This newly attached particle denotes that NP *Taro* is the causee of the causative construction as well as the agent of the embedded clause. Since Permissive Causatives are allowed only in sentences in which main dative verbs (requiring two argument NPs) denote activity or psychological state of their nominative subject, following the thematic hierarchy, it can be said that the subjects in (3) and (4) seem to appear in the position higher than the dative objects. Therefore the sentences in (3a) and (4a) have canonical word order and those in (5a) and (5b) are sentences with derived word order by means of scrambling and have a more complex structure as accusative verb sentences in (2). The structures of the sentences with two word orders are schematically represented in (9).

(9) a. [$_{IP}$ NP-NOM NP-DAT Verb] *Canonical word order*
b. [$_{IP}$ NP-DAT [$_{IP}$ NP-NOM *t* Verb]] *Scrambled word order*

3. Hypothesis

Given the above theoretical analyses for scrambling in Japanese, we hypothesize that during comprehension there occurs scrambling effect on dative object sentences and that the effect induces more cognitive load, resulting in longer reading times in sentences with scrambled word order. Such a cognitive load stems from the reconstruction of a displaced object NP into its base position in the manner of Frazier and Clifton's (1989) gap-filling parsing, as schematically illustrated in (10).

(10)



A gap-filling parsing in a dative verb sentence with scrambled word order

When we process a sentence with the syntactic structure in (10), a displaced object NP would be automatically placed back into its base position to receive proper thematic role from a main verb. This gap-filling parsing leads to longer reading times in comprehension of sentences with scrambled word order than those with canonical word order. To test our hypothesis, we conducted a psycholinguistic experiment.

4. Methods

4.1 Participants

Twenty four graduate and undergraduate students (13 males and 11 females, mean age: 21.10) at Tohoku University participated in this experiment. All were native Japanese speakers.

4.2 Materials

96 experimental (48 correct and 48 incorrect) and 144 filler sentences were prepared for this experiment.[2] Experimental sentences were mono-transitive dative object sentences and each sentence consisted of a nominative subject NP-*ga*, a dative object NP-*ni* and a past form of a verb V-*ta*. All verbs were types of those mentioned in section 2, as repeatedly shown in (11) and (12).

(11) a. Taro-ga gakkoo-ni itta.
b. Gakkoo-ni Taro-ga itta.
(12) a. Jiro-ga Kaori-ni horeta.
b. Kaori-ni Jiro-ga horeta.

Correct "Yes" responses were consisted of 24 sentences with canonical word order such as (11a) and (12a) and their 24 scrambled counterparts such as (11b) and (12b). Incorrect "NO" responses were consisted of 24 canonical word order sentences (12 subject and 12 object semantically deviant sentences) and their 24 scrambled counterparts. Two lists of 12 correct canonical, 12 correct scrambled, 12 incorrect canonical, 12 incorrect scrambled sentences and 72 filler sentences were prepared and distributed to two groups of participants. Each participant saw either of the two lists and did not see the same word within the list.

4.3 Procedure

Stimuli were visually presented on the PC screen controlled by Lingua Lab ver.3.05. Following 1500 ms presentation of an eye fixation point "+", each stimulus was presented in the middle of the screen, and the presentation was pseudo randomized in order. Participants were instructed to respond as accurately and as quickly as possible in decision of whether the sentence made sense or not (semantic judgment). Reading time was measured from the onset of stimulus presentation to the response of the participants by pressing a "Yes" or "No" button. After sixteen practice trials, each participant went on to actual testing.

5. Results and Analysis

Reaction times less than 500ms and longer than 5000ms were recorded as missing value. Before performing the analysis reaction times outside of 2.5 standard deviations at both the high and low ranges were replaced by boundaries indicated by 2.5 standard deviations from the individual means of participants in each category. Only correct responses for "Yes" items were used in the analyses of reaction times and error rates. Reaction times and error rates are presented in Table1.

Table1. Reaction times and Error rates for Dative Object Sentences

	Reaction time (ms)		Error rate (%)	
Word Order	Mean	SD	Mean	SD
SOV	1508	371	3.65	3.75
VOS	1843	471	8.51	7.42

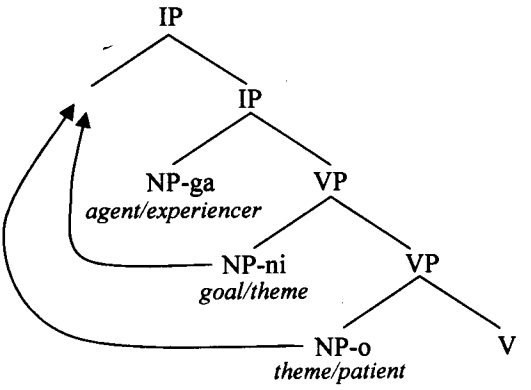
A series of one-way analyses of variance (ANOVAs) with repeated measures in the canonical and scrambled word orders were conducted on both reaction times (milliseconds) and error rates (percentages), using subject ($F1$) and item ($F2$) variability. The analyses showed that for the scrambled word order the reaction time was significantly longer [$F_1(1, 23) = 7.44, p < 0.01$; $F_2(1, 23) = 7.44, p < 0.001$] and the error rate was significantly higher [$F_1(1, 23) = 8.20, p < 0.01$; $F_2(1, 23) = 4.64, p < 0.05$] than those for the canonical word order.

6. Discussion

The result of the experiment showed that processing sentences with scrambled word order resulted in significantly longer reading times than sentences with canonical word order. This result was analogous with those of the previous psycholinguistic studies on scrambling effects in Japanese (Chujo 1983, Mazuka et al. 2002, Kim et al. 2004).

Consider the following syntactic structure (13).

(13)



As mentioned above, the syntactic structure in (13) shows that an accusative object and a dative object reside in the different positions in which the base position of a dative object is higher than that of an accusative object. When objects are displaced to the IP-adjoined position by scrambling, the landing site for the displaced objects would be the same position. Therefore, the distance between the landing site for scrambling and the base position of a dative object is shorter than that of an accusative object. Despite the shorter distance for a gap-filling parsing (Frazier and Clifton 1989) in the dative verb sentences, scrambling effects were observed. This result supports the argument of the existence of scrambling effects in sentence processing of mono-transitive and ditransitive sentences in Japanese. This existence of scrambling effects in Japanese, in turn, supports the proposal in theoretical linguistics that a sentence with scrambled word order is derived from a canonical word order and that the former has a more complex syntactic structure than the latter, and that Japanese is also one of the configurational languages with movement, (cf. Hale 1980, Hoji 1985, Saito 1985).

7. Conclusion

This study proved that there is scrambling effect on mono-transitive dative verb sentences, and particularly observed in significantly longer reading times in sentences with scrambled word order. The result also supports the argument of the configurationality of Japanese. Japanese has various types of "dative particle *ni*", so further studies targeting other than sentences with "argument" dative object NPs are remaining. We hope that future studies will reveal the syntactic nature of the particle in Japanese.

Notes

This study has benefited from the comments and suggestion of Masatoshi Koizumi. I would like to thank Naoki Kimura and Jong Ho Kim for their helpful comments, too. All remaining errors are, of course, my own.

1. Tamaoka et al. (2005)'s study used the following sentences (i) and (ii) in Japanese.

(i) Junko-ga Taro-ni ker-are-ta.
Junko-NOM Taro-DAT kick-PASS-PAST
"Junko was kicked by Taro."

(ii) Takashi-ni girishago-ga kak-eru-daroo-ka
Takashi-DAT Greek-NOM write-POT-wonder-Q
"I wonder if Takashi can write Greek?"

Each sentence in (i) and (ii) involves two NPs: one with a "nominative" case particle and the other with a "dative" case particle. Although these sentences are similar to those we used in this study, they are not genuine mono-transitive dative verb sentences. The sentence (i) is one of the Passive Constructions and the sentence (ii) is one of the Potential Constructions, and each has a mono-transitive counterpart as shown in (iii) and (iv).

(iii) Taro-ga Junko-o ket-ta.
Taro-NOM Junko-ACC kick-PAST
"Taro kicked Junko."

(iv) Takashi-ga girishago-o kai-ta.
Takashi-NOM Greek-ACC write-PAST
"Takashi wrote Greek."

Since sentences (i) and (ii) are complex sentences derived by sentences (iii) and (iv), respectively, we didn't use these types of sentences in this study.

2. In this study, we also conducted another psycholinguistic study on scrambling effects on another type of sentence at the same time, whose canonical word order is *NP-ni NP-ga Verb* and scrambled word order is *NP-ga NP-ni Verb*. Thus among the 114 fillers, in fact, 96 sentences were prepared for the second study. But owing to lack of space, the second study was not discussed in this paper.

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- 東北大学大学院生 -